NASA STTR 2014 Phase I Solicitation

T8   Science Instruments, Observatories and Sensor Systems

Science Instruments, Observatories, and Sensor Systems addresses technologies that are primarily of interest for missions sponsored by NASA's Science Mission Directorate and are primarily relevant to space research in Earth science, heliophysics, planetary science, and astrophysics. This topic consists of three Level 2 technology subareas:

- Remote sensing instruments/sensors.
- Observatories.
- In situ instruments/sensors.

Subtopics

T8.01 Technologies for Planetary Compositional Analysis and Mapping

Lead Center: JPL

Participating Center(s): LaRC

This subtopic is focused on developing and demonstrating technologies for both orbital and in situ compositional analysis and mapping that can be proposed to future planetary missions. Technologies that can increase instrument resolution, precision and sensitivity or achieve new and innovative scientific measurements are solicited. For example missions, see (http://science.hq.nasa.gov/missions). For details of the specific requirements see the National Research Council's, Vision and Voyages for Planetary Science in the Decade 2013-2022 (http://solarsystem.nasa.gov/2013decadal/).

Possible areas of interest include:

- Improved sources such as lasers, LEDs, X-ray tubes, etc. for imaging and spectroscopy instruments (including Laser Induced Breakdown Spectroscopy, Raman Spectroscopy, Deep UV Raman and Fluorescence spectroscopy, Hyperspectral Imaging Spectroscopy, and X-ray Fluorescence Spectroscopy).
- Improved detectors for imaging and spectroscopy instruments (e.g., flight-compatible iCCDS and other time-gated detectors that provide gain, robot arm compatible PMT arrays and other detectors requiring high voltage operation, detectors with improved UV and near-to-mid IR performance, near-to-mid IR detectors with reduced cooling requirements).
- Technologies for 1-D and 2-D raster scanning from a robot arm.
- Novel approaches that could help enable in situ organic compound analysis from a robot arm (e.g., ultra-miniaturized Matrix Assisted Laser Desorption-Ionization Mass Spectrometry).
- "Smart software" for evaluating imaging spectroscopy data sets in real-time on a planetary surface to guide

rover targeting, sample selection (for missions involving sample return), and science optimization of data returned to earth.
- Other technologies and approaches (e.g., improved cooling methods) that could lead to lower mass, lower power, and/or improved science return from instruments used to study the elemental, chemical, and mineralogical composition of planetary materials.

Projects selected under this subtopic should address at least one of the above areas of interest. Multiple-area proposals are encouraged. Proposers should specifically address:

- The suitability of the technology for flight applications, e.g., mass, power, compatibility with expected shock and vibration loads, radiation environment, interplanetary vacuum, etc.
- Advantages of the proposed technology compared to the competition.
- Relevance of the technology to NASA's planetary exploration science goals.

Phase I contracts will be expected to demonstrate feasibility, and Phase II contracts will be expected to fabricate and complete laboratory testing on an actual instrument/test article.

T8.02 Next Generation Total Lightning Detection Sensor

Lead Center: KSC

Participating Center(s): GSFC, LaRC, MSFC, SSC

NASA is concerned with the uncertainty of the current lightning detection sensors NASA is concerned with the uncertainty of current lightning detection sensors. The location accuracy and detection efficiency are both lacking, currently at less than 90% and 250m respectively. Total lightning detection with location accuracy in the meters should be the requirement of the next generation launch vehicle and ground operations. NASA seeks to foster research and development that leads to innovative new technologies and methods, or significant improvements in existing technologies, for in-cloud and cloud-to ground lightning detection. The current total lightning detection technology has been fairly stagnant for the last decade, with the only improvements being small tweaks to location accuracy and classification algorithms and requiring both a suite of cloud-to-ground sensors and inter-cloud sensors. The combination is cost prohibitive to most locations and requires a large array of sensors spanning tens of meters to create solutions. Through current collaborations with other government agencies, the NASA team has come across several universities and at least two small businesses that have conceptual designs that could potentially deliver a brand new sensor with the detection capability to meet the important technology gap. Based on an early assessment of these small business and university concepts, it is likely that systems could be developed within the next 2-3 years, at great cost efficiencies for NASA while providing the needed detection and location accuracy.

Under this subtopic, proposals are invited that explore novel sensors and sensor systems for the detection of both inter-cloud and cloud-to-ground lightning. With regard to detection efficiency and location accuracy, the emphasis is developing systems that have a near total detection and are accurate within 10s of meters. Approaches that use multiple sensors in combination to improve detection and location are also of interest. Technologies may take the form of prototypes and/or devices.